

DICK
172
HOUSATONIC RIVER FLOOD CONTROL

DANBURY, CONN.

LOCAL PROTECTION

STILL RIVER, CONNECTICUT

DESIGN MEMORANDUM NO. 3

CONCRETE MATERIALS



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

MAY 1969



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-E

16 May 1969

SUBJECT: Danbury Local Protection Project, Still River,
Housatonic River Basin, Connecticut, Design
Memorandum No. 3 - Concrete Materials

Chief of Engineers
ATTN: ENGCW-E

There is submitted herewith for review and approval, Design
Memorandum No. 3, Concrete Materials, for the Danbury Local
Protection Project, Still River, Housatonic River Basin,
Connecticut, in accordance with ER 1110-2-1150.

FOR THE DIVISION ENGINEER:

1 Incl (5 cys)
as

John Wm Leslie
JOHN Wm. LESLIE
Chief, Engineering Division

FLOOD CONTROL PROJECT

DANBURY LOCAL PROTECTION PROJECT
STILL RIVER
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3

CONCRETE MATERIALS

INDEX TO DESIGN MEMORANDA

<u>No.</u>	<u>Title</u>	<u>Date Submitted</u>	<u>Date Approved</u>
1	Hydrology and Hydraulic Design	29 August 1968	23 October 1968
2	General Design and Site Geology	21 January 1969	
3	Concrete Materials		
4	Embankment, Foundations and Channel Improvements	30 April 1969	
5	Structures	30 April 1969	

DANBURY LOCAL PROTECTION PROJECT
DANBURY, CONNECTICUT

DESIGN MEMORANDUM NO. 3

CONCRETE MATERIALS

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FLOOD CONTROL PROJECT

DANBURY LOCAL PROTECTION PROJECT

DESIGN MEMORANDUM NO. 3

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MAY 1969

1. General. The project, located in the City of Danbury, Connecticut, will require approximately 25,000 cubic yards of concrete for construction of a U-shaped channel structure and box culverts. The concrete will be subjected to severe climatic conditions with alternate cycles of freezing and thawing during the winter months. Therefore, air entrained concrete is considered mandatory to provide the required durability of the structures. The structures which will be subjected to low velocity flows of water will require only regular quality structural concrete. Considering the moderately small quantity of concrete required, the specifications will provide for use of a semi-automatic control concrete plant with the concrete mixed by a stationary, truck or paving mixer.

2. Cementing Materials. The size of the monoliths will not result in excessive thermal stresses nor does the location of the structure involve sulfate exposure. Therefore, the use of Type I portland cement will satisfy the chemical and physical cement requirements for this project. It is not considered economically feasible to use pozzolan or special cements for this project because of the small quantity of concrete required. No special investigations of portland cements have been conducted because the cement used in this area is usually supplied by one of six cement mills located in the New York Hudson River Valley or from one of eight mills located in the Pennsylvania Lehigh Valley. Five of the six mills located in the New York Hudson River Valley do not manufacture Type I portland cement but do manufacture Type II. Therefore, Type I or Type II portland cement will be specified.

3. Aggregates.

a. Field Investigation. In view of the small quantity of concrete required for the structures, the concrete aggregate investigations were confined to established commercial companies producing fine and/or coarse aggregate and these companies will be referred to hereinafter as the aggregate source. A field reconnaissance (June 1968) was performed by an engineer-geologist team to locate and ascertain the availability of sources of concrete aggregates within a fifteen mile radius of the project site. There are nine commercial sources of processed natural sand and gravel within a fifteen mile radius of the project site. One source of processed crushed quarry stone is located fifty miles from the site and has facilities for shipping aggregate by rail. Table I lists the location, plant capacity, and haul distance to the project site of each source of aggregate checked during the field reconnaissance.

TABLE I

<u>Aggregate Source and Location</u>	<u>Plant Capacity (Tons per Hour)</u>	<u>Haul Distance (Miles)</u>
B. J. Dolan, Inc. Bethel, Connecticut	100	2
Bethel Sand & Gravel Co. Bethel, Connecticut	60	4
Danbury Sand & Gravel Co. Danbury, Connecticut	130	4
Federal Sand & Gravel Co. Brookfield, Connecticut	100	4
Brookfield Sand & Gravel, Inc. Brookfield, Connecticut	120	7
Brewster Sand & Stone Corp. Brewster, Connecticut	70	7
Sega Sand & Gravel Co. New Milford, Connecticut	150	11
Loma Sand & Gravel, Inc. Newtown, Connecticut	100	12
D'Addario Sand & Gravel Co. Newtown, Connecticut	200	15
New Haven Trap Rock Co. ⁽¹⁾ Wallingford, Connecticut	500	50

(1) Produce Crushed Quarry Stone coarse aggregate only.

The locations of the project site and commercial sources of aggregates listed above are shown on Plate No. 3-1. Considering the quantity of concrete required, it is presumed that concrete will be obtained for the project from one of the ready-mix concrete suppliers that deliver in Danbury. Danbury Sand and Gravel Company does not supply concrete aggregate to a ready-mix concrete plant and its aggregate material is primarily used in the manufacture of concrete blocks. Bethel Sand and Gravel Company and the Segal Sand and Gravel Company supplies aggregates to Segal Concrete Company's plant. However, the Segal Concrete Company is non-union and is not considered as a potential concrete supplier for this project. Brookfield Sand and Gravel Company supplies aggregates to Telesco Mason Supply Company's concrete plant located in Brookfield, Connecticut. This concrete plant is not normally operated and the primary use of the aggregates from Brookfield Sand and Gravel Company is for use in bituminous concrete. Brewster Sand and Stone Corporation operates a concrete plant adjacent to its aggregate plant. However, due to a higher wage scale and longer haul distance, this concrete plant is not considered economically competitive with the concrete plants located in Danbury and Bethel, Connecticut. Loma Sand and Gravel Company supplies aggregates to Monroe Ready-Mix Concrete Company's plant located in Newtown, Connecticut. The Monroe Ready-Mix Concrete Company is non-union and is not considered a potential concrete supplier for this project. The Federal Sand Gravel Company normally supplies aggregates to Telesco Mason Supply Company's concrete plant in Danbury. B. J. Dolan, Incorporated utilizes its aggregates in its concrete plant located in Bethel. D'Addario Sand and Gravel Company supplies aggregates to its concrete plant in Danbury. New Haven Trap Rock Company has supplied coarse aggregate by rail to the concrete plants of the Telesco Mason Supply Company and the D'Addario Concrete Service Company which are both located in Danbury, for construction of concrete structures and rigid pavement of interstate highway work in the Danbury area. The aggregates produced by the plants of the Federal Sand and Gravel Company, B. J. Dolan, Incorporated and D'Addario Sand and Gravel Company were selected for evaluation testing since these companies are considered to have the best potential for supplying aggregates to the project. Aggregates produced by the aggregate plant of the New Haven Trap Rock Company has been previously tested and approved for civil works construction. Photographs of the working faces of the quarry of New

Haven Trap Rock Company are shown on Plate No. 3-8. The maximum size of coarse aggregates commercially available is 1-1/2 inches. Because of the placing condition in relatively narrow, heavily reinforced concrete walls and slabs, an aggregate size larger than 1-1/2 inches is not being considered.

b. Tested Sources and Estimated Prices. The sources of aggregate tested and estimated delivered prices to the project site of these aggregates, based on the quoted plant prices and Connecticut Department of Public Utilities minimum trucking rates, which are currently fifty-five cents per ton for the first four miles and seven cents per ton for each additional mile are as follows:

(1) B. J. Dolan, Incorporated. Quoted plant prices are \$2.75 per ton for gravel and \$1.35 per ton for concrete sand. The delivered prices to the site will be \$3.35 per ton for gravel and \$1.95 per ton for concrete sand.

(2) Federal Sand and Gravel Company. Quoted plant prices are \$2.70 to \$3.00 per ton for gravel, depending on size group; and \$1.60 per ton for concrete sand. The delivered prices to the site will average \$3.60 per ton for gravel and \$2.05 per ton for concrete sand.

(3) D'Addario Sand and Gravel Company. Quoted plant prices are \$3.00 to \$4.00 per ton for gravel, depending on size group and \$2.00 per ton for concrete sand. The delivered prices to the site will average \$4.95 per ton for gravel and \$3.45 per ton for concrete sand.

(4) New Haven Trap Rock Company. Quoted plant prices are \$2.05 to \$3.20 per ton for crushed stone, depending on size group. The delivered price by rail will average \$3.45 per ton for crushed stone.

c. Aggregate Tests. Results of aggregate tests are summarized on Plates Nos. 3-2 through 3-4. Test data for coarse aggregates produced by the New Haven Trap Rock Company are reported in Technical Memorandum No. 6-370 "Test Data - Concrete Aggregate in Continental United States", Volume 5, Latitude 41°N, Longitude 72°W Index No. 6. The petrographic examination of a current sample of aggregate from this source indicates that the material is now identical to that previously tested.

d. Concrete - Making Properties of Aggregates. The water cement ratio and cement factor versus compressive strength curves developed by utilizing concrete aggregates from the sources selected for evaluation are shown on Plates Nos. 3-5 through 3-7 for all sources except New Haven Trap Rock Company.

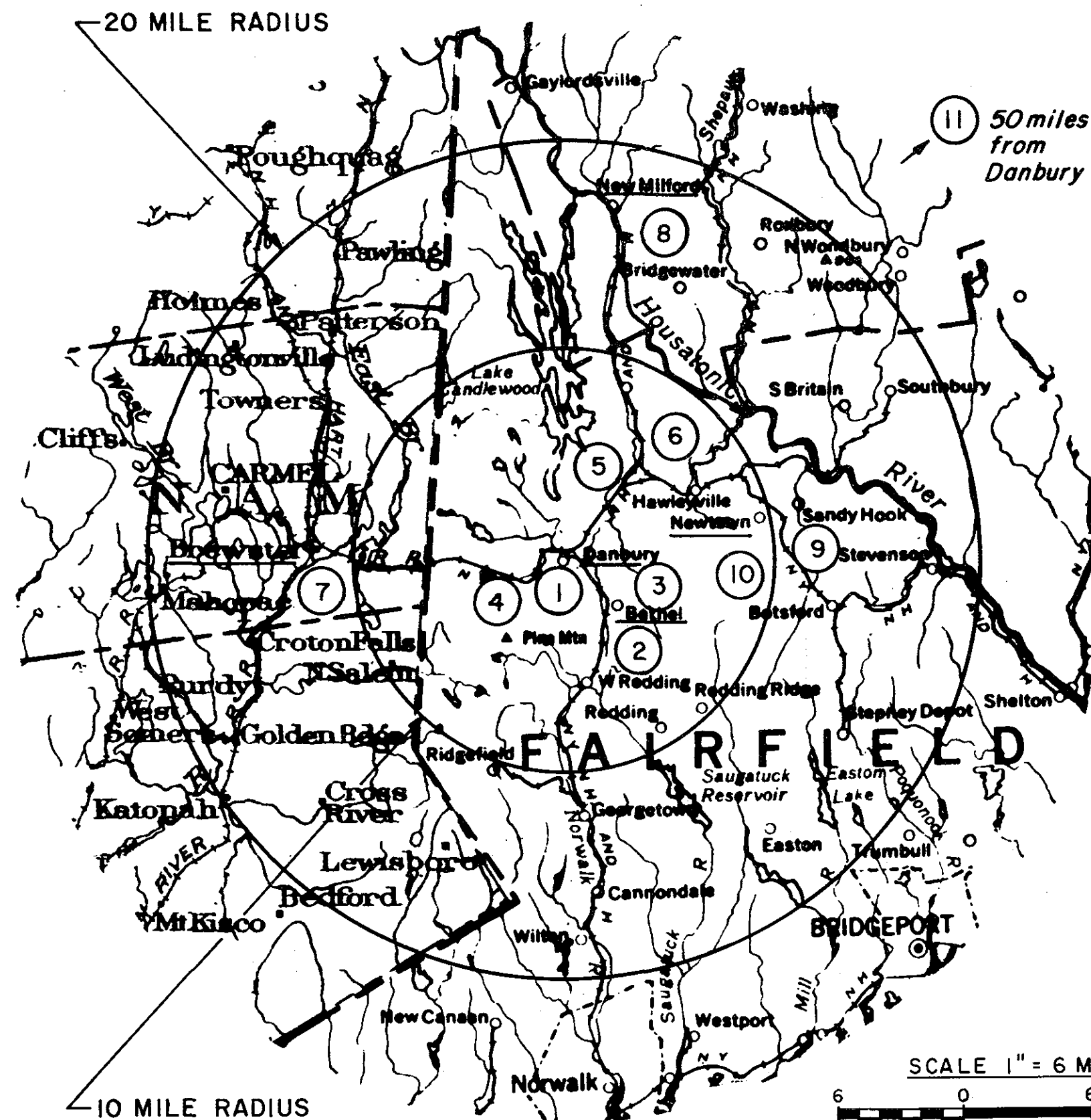
e. Service Records. The aggregates from the sources selected for evaluation testing have been used in concrete for a number of Federal, State and local projects. B. J. Dolan, Incorporated has used sand and gravel aggregates regularly from its concrete plant for local and state building construction. Federal Sand and Gravel Company has supplied sand and gravel aggregates regularly to Tedesco Mason Supply Company and Concrete plant for concrete which has been used in construction of local and state buildings and state highway bridges. D'Addario Sand and Gravel Company has supplied sand and gravel aggregates regularly to its concrete plants located in Bridgeport and Danbury, Connecticut and concrete from these plants has been used for local building construction, including urban renewal, floodwalls on the Still River in Danbury and for bridge structures on the Connecticut Turnpike in Bridgeport, Connecticut. The crushed stone supplied from New Haven Trap Rock Company plant has been used for many years in the production of concrete pavements and structures in the States of Connecticut, Rhode Island and New York for projects under control of the New York Port Authority and in Corps of Engineers civil works and military projects, including airfield pavements. The performance of aggregates from all of the sources is considered satisfactory, although it must be noted that the period of record is less than ten years, except for aggregate produced by the New Haven Trap Rock Company which has a fifty year record of service and is considered excellent.

4. Water. It is assumed that water for both mixing and curing will be obtained from a city or town water supply and, since the exact sources cannot be predetermined, tests have not been performed. Sources of water proposed by the contractor will be tested prior to use.

5. Sources of Concrete. There are six suppliers of ready-mixed concrete with manual control transit-mix type concrete plants located within a fifteen mile haul distance of the project site. Telesco Mason Supply Company operates plants in Danbury and Brookfield, Connecticut.

B. J. Dolan, Incorporated operates a plant in Bethel, Connecticut. D'Addario Concrete and Asphalt Service Incorporated operates a plant in Danbury, Connecticut. Sega Concrete Company operates plants in Bethel and New Milford, Connecticut. Brewster Sand and Stone Corporation operates a plant in Brewster, New York. Monroe Ready-Mix Concrete Company operates a plant in Newtown, Connecticut.

6. Recommendations and Conclusions. Based on the data presented herein, it is considered that concrete aggregates from any of the four sources tested are acceptable and it is recommended that fine aggregate from three sources and coarse aggregates from these four sources, as listed, be approved.



- ① Danbury Local Protection Project
- ② B.J. Dolan, Inc.
- ③ Bethel Sand and Gravel Co.
- ④ Danbury Sand and Gravel Co.
- ⑤ Federal Sand and Gravel Co.
- ⑥ Brookfield Sand and Gravel, Inc.
- ⑦ Brewster Sand and Stone Corp.
- ⑧ Segal Sand and Gravel Co.
- ⑨ Loma Sand and Gravel Co.
- ⑩ D'Addario Sand and Gravel Co.
- ⑪ New Haven Trap Rock Co.

HOUSATONIC RIVER FLOOD CONTROL

DANBURY

LOCATION OF COMMERCIAL
CONCRETE AGGREGATE SOURCES

STILL RIVER, CONNECTICUT

STATE: <u>Conn</u>		INDEX NO.:		AGGREGATE DATA SHEET		TESTED BY: <u>NED LABORATORY</u>	
LAT: <u>41°N</u>		LONG: <u>73°W</u>		DATE: <u>August 1968</u>			
LAB. SYMBOL NO: <u>73-165-1 and 2</u>				TYPE OF MATERIAL: <u>Processed Sand & Gravel</u>			
LOCATION: <u>207 Greenwood Avenue, Bethel, Connecticut</u>							
PRODUCER <u>B. J. Dolan Sand and Gravel Company</u>							
SAMPLED BY <u>NED, A. Carosella</u>							
TESTED FOR: <u>Danbury Local Protection Project</u>							
USED AT							
PROCESSING BEFORE TESTING <u>Crushing, Sizing and Washing by Producer</u>							
GEOLOGICAL FORMATION AND AGE <u>Terrace Pleistocene (Wisconsin)</u>							

GRADING (CRD-C 103)(CUM. % PASSING)				TEST RESULTS				1" FINE AGG.																										
SIZE / SIEVE		1"	FINE AGG.																															
				BULK SP. GR., SAT SURF DRY (CRD-C 107, 108):				2.67	2.66																									
6 IN.				ABSORPTION, PER CENT (CRD-C 107, 108):				1.3	1.8																									
5 IN.				ORGANIC IMPURITIES, FIG. NO. (CRD-C 121):				—	1																									
4 IN.				SOFT PARTICLES, PER CENT (CRD-C 130):				2	—																									
3 IN.				PER CENT LIGHTER THAN SP. GR. (CRD-C 129):				—	—																									
2 1/2 IN.				PER CENT FLAT AND ELONGATED (CRD-C 119, 120):				3	—																									
2 IN.				WEIGHTED AV. % LOSS, 5 CYC. $MgSO_4$ (CRD-C 115):				8	7 1/4																									
1 1/2 IN.		100		ABRASION LOSS (L. A.), % (CRD-C 117):				3 1/4	—																									
1 IN.		97		UNIT WT., LB/CU FT (CRD-C 106):				102	107																									
3/4 IN.		83		CLAY LUMPS, % (CRD-C 118)																														
1/2 IN.		55																																
3/8 IN.		38	100	SPECIFIC HEAT, BTU/LB/DEG. F. (CRD-C 124):																														
NO. 4		17	99	REACTIVITY WITH NaOH (CRD-C 128): 5c, mM/L: Rc, mM/L:																														
NO. 8		5	93																															
NO. 16			77	MORTAR-MAKING PROPERTIES (CRD-C 116)																														
NO. 30			51	TYPE <u>II</u> CEMENT, RATIO <u>7</u> DAYS, <u>138</u> %, 28 DAYS, <u>132</u> %																														
NO. 50			27	LINEAR THERMAL EXPANSION $\times 10^{-6}$ DEG. F. (CRD-C 125, 126):																														
NO. 100			8	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>ROCK TYPE</th> <th>PARALLEL</th> <th>ACROSS</th> <th>ON</th> <th>AVERAGE</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>						ROCK TYPE	PARALLEL	ACROSS	ON	AVERAGE																				
ROCK TYPE	PARALLEL	ACROSS	ON	AVERAGE																														
NO. 200		1.7	2.0																															
- 200 ^(a)		0.8	2.2																															
F.M. ^(b)		6.57	2.62																															

(a) CRD-C 105 (b) CRD-C 104

MORTAR: MORTAR-BAR EXPANSION AT 100F, % (CRD-C 123):				FINE AGGREGATE				COARSE AGGREGATE			
				3 MO.	6 MO.	9 MO.	12 MO.	3 MO.	6 MO.	9 MO.	12 MO.
LOW-ALK. CEMENT: % Na_2O EQUIVALENT:											
HIGH-ALK. CEMENT: % Na_2O EQUIVALENT:											

SOUNDNESS IN CONCRETE (CRD-C 40, 114):				F & T	HW-CD	HD-CW
FINE AGG.	<u>Dolan</u>	COARSE AGG:	<u>Dolan</u>	DFE 300	<u>76</u>	
FINE AGG.		COARSE AGG:		DFE 300		

PETROGRAPHIC DATA (CRD-C 127): The coarse aggregate is a natural gravel and is composed of approximately 73% granitic rock types, 15% quartz and quartzite, 5% schist, 4% calcareous rock types, 2% basic rock types and 1% feldspar with 7% highly weathered. The fine aggregate is a natural sand and is composed of approximately 65% quartz and quartzite, 10% granite, 9% feldspar, 3% calcareous rock types, 2% schist and 8% miscellaneous.

REMARKS:

STATE: Conn.		INDEX NO.:		AGGREGATE DATA SHEET		TESTED BY: NED Laboratory	
LAT: 41°N		LONG: 73°W		DATE: August 1968			
LAB. SYMBOL NO.: 76-163-1 thru 3				TYPE OF MATERIAL Sand and Gravel			
LOCATION: Button Shop Road, Newton, Conn.							
PRODUCER: D'Addario Sand and Gravel Company							
SAMPLED BY: NED - A. Carosella							
TESTED FOR: Danbury Local Protection Project							
USED AT:							
PROCESSING BEFORE TESTING: Crushing, Washing and Sizing by Producer							
GEOLOGICAL FORMATION AND AGE: Terrace Pleistocene (Wisconsin)							

GRADING (CRD-C 103) (CUM. % PASSING)				TEST RESULTS																												
SIZE			FINE AGG.				FINE AGG.																									
SIEVE		3/4"	3/8"																													
6 IN.				BULK SP. GR., SAT SURF DRY (CRD-C 107, 108):		2.69	2.68																									
5 IN.				ABSORPTION, PER CENT (CRD-C 107, 108):		1.1	1.3																									
4 IN.				ORGANIC IMPURITIES, FIG. NO. (CRD-C 121):			1																									
3 IN.				SOFT PARTICLES, PER CENT (CRD-C 130):		2																										
2 1/2 IN.				PER CENT LIGHTER THAN SP. GR. (CRD-C 129):																												
2 IN.				PER CENT FLAT AND ELONGATED (CRD-C 119, 120):		5																										
1 1/2 IN.				WEIGHTED AV. % LOSS, 3 CYC M ₉₅ SO ₄ (CRD-C 115):		6	8																									
1 IN.		100		ABRASION LOSS (L.A.), % (CRD-C 117):		32																										
3/4 IN.		83		UNIT WT., LB/CU FT (CRD-C 106):		96	99																									
3/8 IN.		31	100	CLAY LUMPS, % (CRD-C 118):			112																									
3/16 IN.		8	93	SPECIFIC HEAT, BTU/LB/DEG. F. (CRD-C 124):																												
NO. 4		4	41	REACTIVITY WITH NaOH (CRD-C 128):	Sc, mm/L:																											
NO. 8			8		Rc, mm/L:																											
NO. 16			5	MORTAR-MAKING PROPERTIES (CRD-C 116)																												
NO. 30			38	TYPE II CEMENT, RATIO 7 DAYS, 116 %, 28 DAYS, 121 %																												
NO. 50			21	LINEAR THERMAL EXPANSION X 10 ⁻⁶ /DEG. F. (CRD-C 125, 126):																												
NO. 100			5	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>ROCK TYPE</th> <th>PARALLEL</th> <th>ACROSS</th> <th>ON</th> <th>AVERAGE</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>				ROCK TYPE	PARALLEL	ACROSS	ON	AVERAGE																				
ROCK TYPE	PARALLEL	ACROSS	ON	AVERAGE																												
NO. 200		1.1	1.1																													
- 200 ^(a)		1.0	0.8																													
F.M. ^(b)		6.925	4.42																													

(a) CRD-C 105 (b) CRD-C 104

MORTAR:

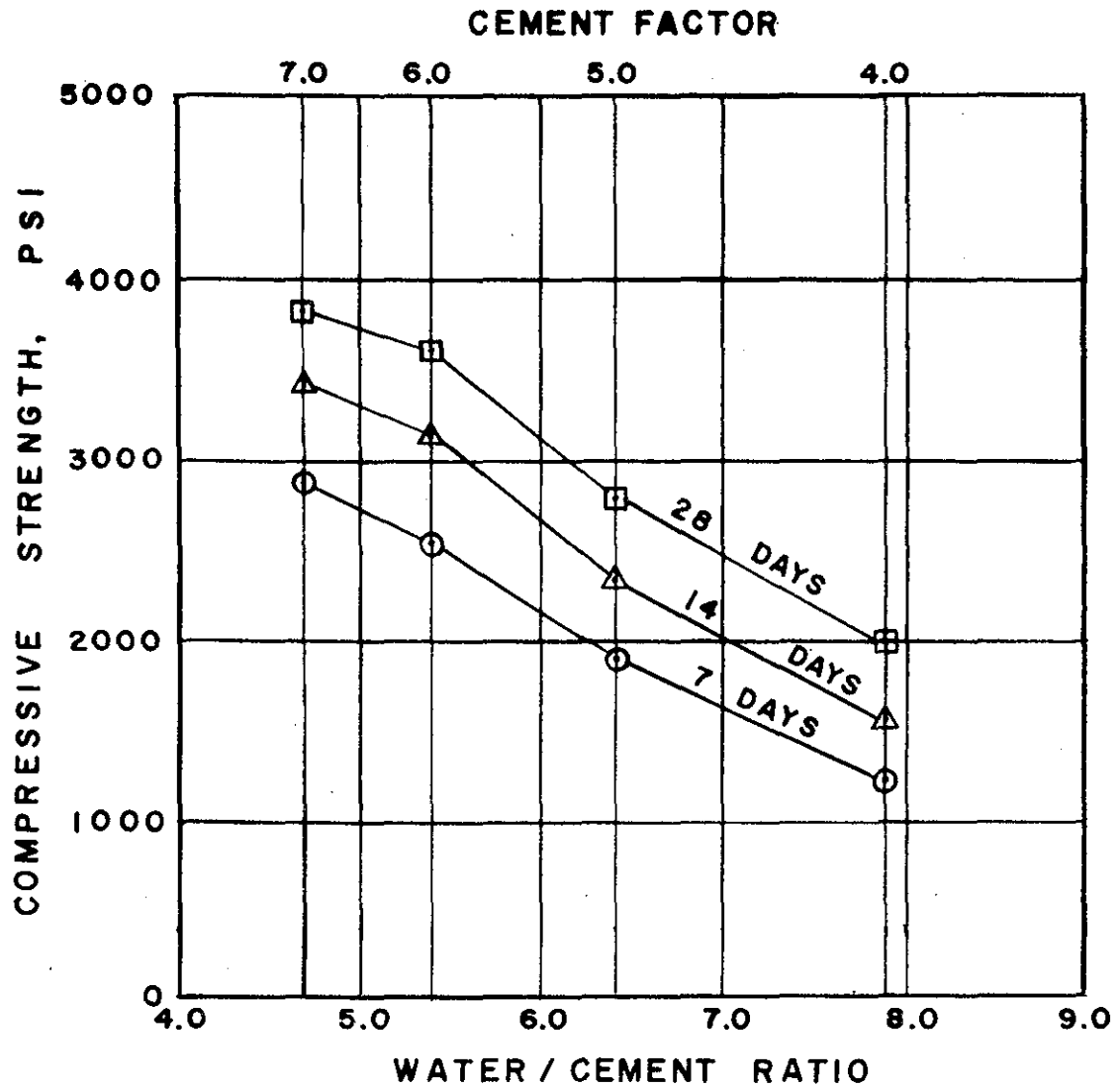
MORTAR - BAR EXPANSION AT 100°F, % (CRD-C 123):	FINE AGGREGATE				COARSE AGGREGATE			
	3 MO.	6 MO.	9 MO.	12 MO.	3 MO.	6 MO.	9 MO.	12 MO.
LOW-ALK. CEMENT: % Na ₂ O EQUIVALENT:								
HIGH-ALK. CEMENT: % Na ₂ O EQUIVALENT:								

SOUNDNESS IN CONCRETE (CRD-C 40, 114):

	F & T	HW - CD	HD - CW
FINE AGG. D'Addario COARSE AGG: D'Addario	DFE ₃₀₀	69	
FINE AGG. COARSE AGG:	DFE ₃₀₀		

PETROGRAPHIC DATA (CRD-C 127): The coarse aggregate is a natural gravel and is composed of approximately 67% granitic rock types, 18% quartz and quartzite, 11% schist and 4% basic rock types with 4% highly weathered. The fine aggregate is a natural sand and is composed of approximately 61% quartzite and quartz, 19% granitic rock types, 5% schist, 5% feldspar, 2% basic rock types and 8% miscellaneous.

REMARKS:

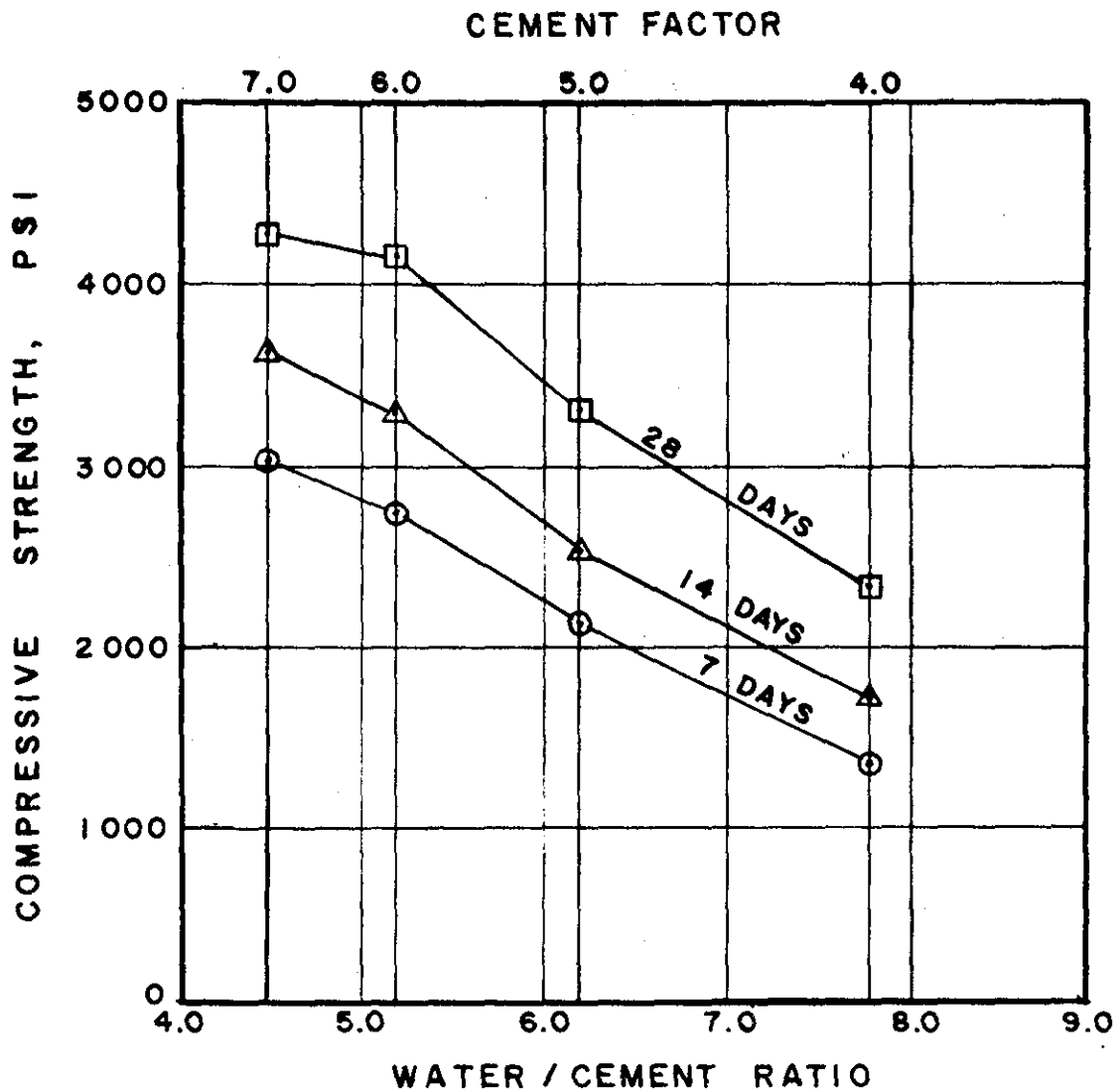


B. J. DOLAN SAND & GRAVEL CO.
BETHEL, CONN.

NOTE

CONCRETE WITH 1" MAXIMUM
SIZE COARSE AGGREGATE, 3-INCH
SLUMP, 6.0% ENTRAINED AIR, TYPE
II PORTLAND CEMENT.

HOUSATONIC RIVER FLOOD CONTROL
DANBURY
CONCRETE MAKING
PROPERTIES
STILL RIVER, CONNECTICUT

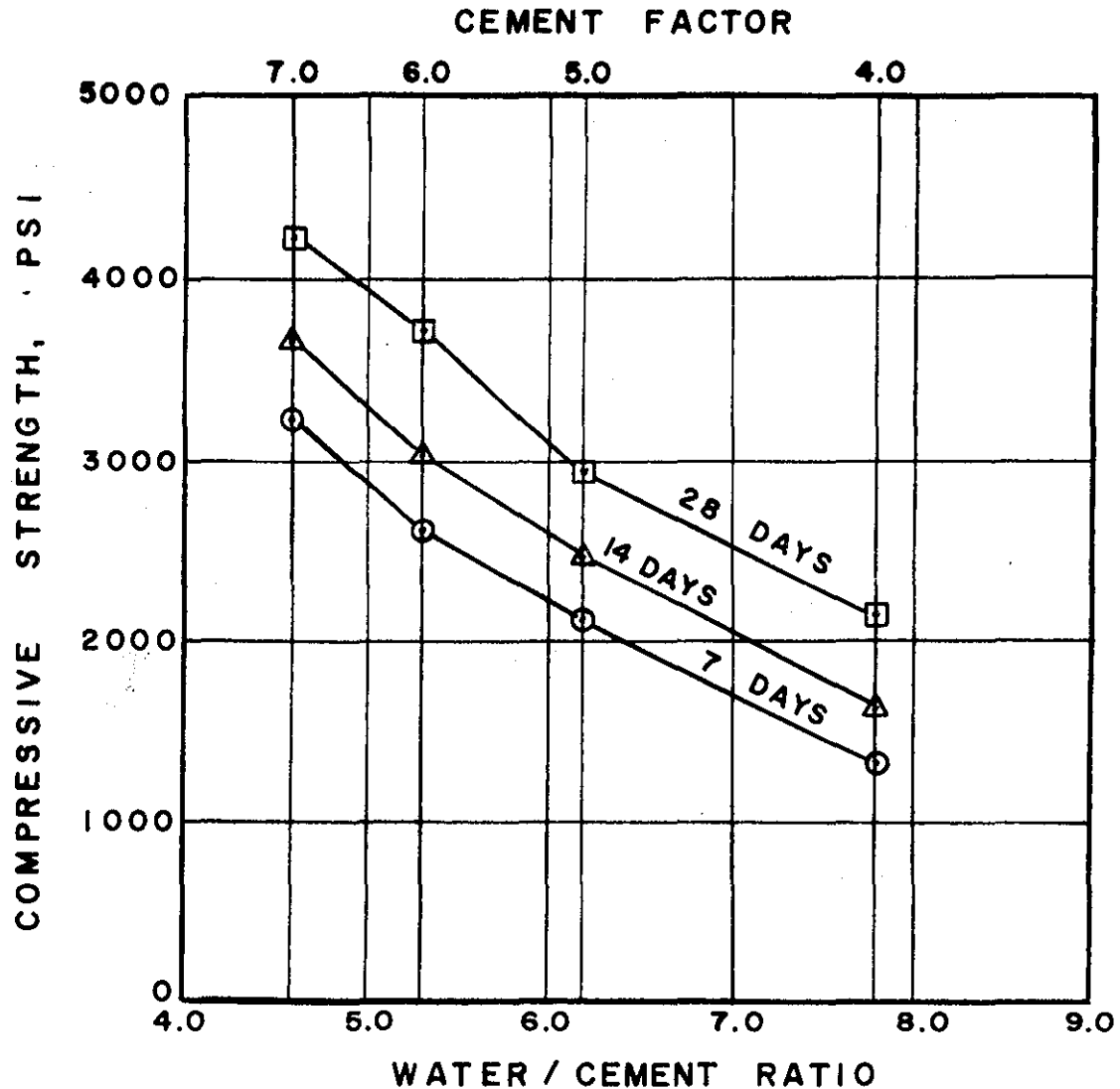


FEDERAL SAND & GRAVEL CO.
BROOKFIELD, CONN.

NOTE

CONCRETE WITH 3/4" MAXIMUM
SIZE COARSE AGGREGATE, 3-INCH
SLUMP, 6.0% ENTRAINED AIR, TYPE
II PORTLAND CEMENT.

HOUSATONIC RIVER FLOOD CONTROL
DANBURY
CONCRETE MAKING
PROPERTIES
STILL RIVER, CONNECTICUT

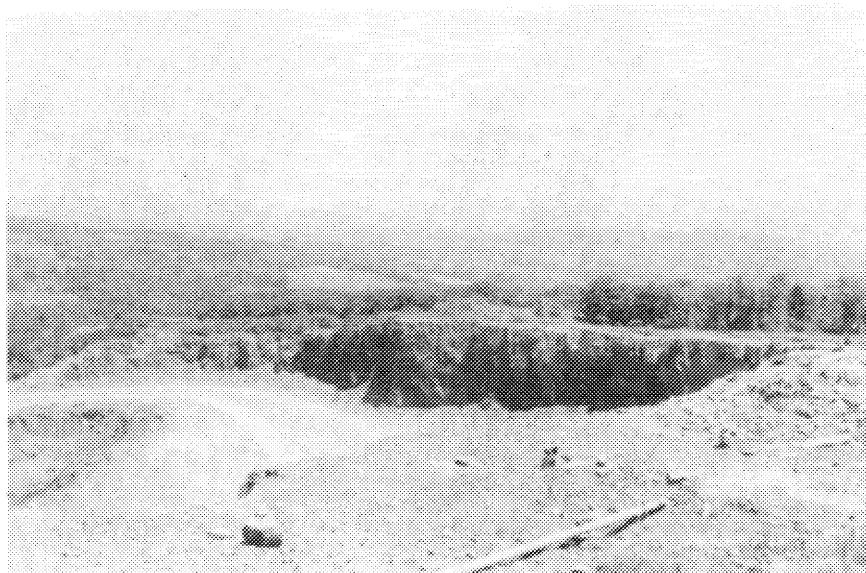


D'ADDARIO SAND & GRAVEL CO.
NEWTOWN, CONN.

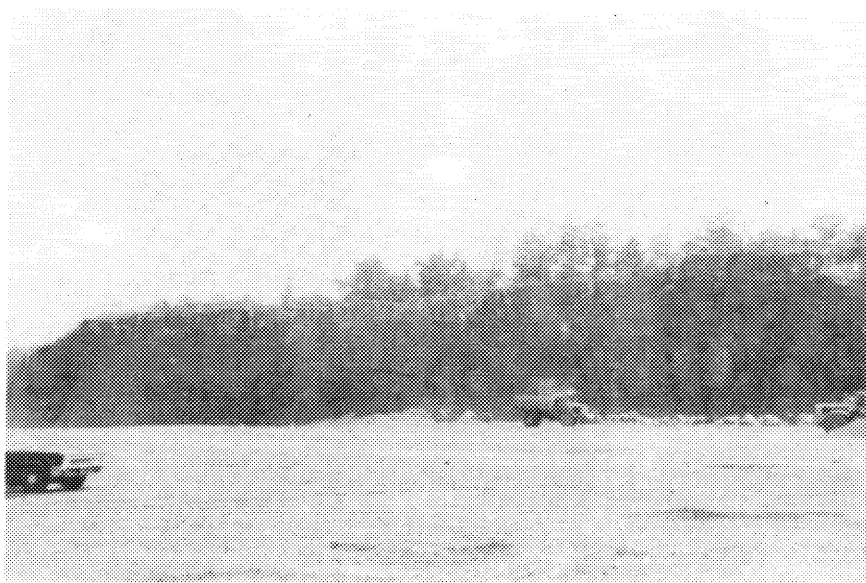
NOTE

CONCRETE WITH 3/4" MAXIMUM
SIZE COARSE AGGREGATE, 3-INCH
SLUMP, 6.0% ENTRAINED AIR, TYPE
II PORTLAND CEMENT.

HOUSATONIC RIVER FLOOD CONTROL
DANBURY
CONCRETE MAKING
PROPERTIES
STILL RIVER, CONNECTICUT



New Haven Trap Rock Company
Wallingford, Connecticut
Quarry face 1500 feet long



New Haven Trap Rock Company
Wallingford, Connecticut
Quarry face 300 feet high